BULLETIN

THE AMERICAN INTERPLANETARY SOCIETY

113 West 42nd Street, New York, N. Y.

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No. 15 | New York | January 1932

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SOVIET ENGINEERS CONSTRUCTING TWO ROCKETS

A despatch to the New York Times from Moscow indicates that research engineers of the Leningrad Osoaviakhim are constructing two rockets. One is for recording purposes only, as it is planned to be shot to an altitude of thirty miles by means of powerful discharges; the other for carrying two passengers to a height of ten miles into the stratosphere.

Both rockets will be cigar-shaped, constructed of light alloys and steel welded together. Once the maximum height is attained, the descent is to be made by parachute. The engineers add hopefully that perhaps in the future rockets will be developed enough to permit exploration of interplanetary spaces.

A communication from Professor Nicholas Rynin of Leningrad, to the Society states that a group of rocket experimenters is now active in Soviet Russia. Its headquarters are at Moscow, and a branch is in Leningrad. The group consists of about 200 engineers and scientists.

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MOON'S SURFACE CHIEFLY PUMICE SAYS CARNEGIE INSTITUTION

As a result of research work conducted by the Carnegie Institution of Washington, the moon's surface is composed chiefly of pumice, volcanic ash, and other rocks of high insulating value, says the Institution.

These conclusions have been arrived at by examining the light reflected from the moon, and comparing it with light reflected from terrestrial rocks and minerals. By one method spectral analysis of moonlight has determined the various colors of which it is composed. Different rocks give different proportions of colors in their reflection spectra, A second method depended on the fact that moonlight is partly polarized, reflected in such a manner that light waves vibrate wholly or principally in a single plane. A third method compared the temperature

of the moon's surface when it was illuminated and in eclipse.

By combining three methods the Carnegie Institution scientists eliminated from the moon's surface the presence of basaltic and granitic rocks and sulphur. The Institution is now exploring the moon's surface is detail by telescope to identify its surface materials with greater certainty,

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FUTURE PROGRAM OF THE SOCIETY

On Friday evening, January 8, Dr. William Lemkin will address the Society on "Rocket Fuels and Their Possibilities."

On Friday evening, January 22, Mr. C. P. Mason will address the Society on "Navigation of Vehicles in Interstellar Space."

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SOCIETY'S ROCKET APPROACHING COMPLETION

A two stick repulsor rocket to be powered by gasoline and liquid oxygen is now approaching completion, under the direction of the Society's engineers, Mr. G. Edward Pendray and Hugh Franklin Pierce. The rocket will be seven feet long, and about eight inches in diameter. After a series of careful static tests, it will finally be released, equipped with a parachute to make a flight into the atmosphere and return safely to earth. This rocket will be used as the basis for a series of experiments, to solve some of the fundamental difficulties of the control and stabilization of rocket vehicles.

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SMITHSONIAN REPORTS GODDARD'S PROGRESS

(The following summary is from the Annual Report of the Smithsonian Institution for the year 1930, and is recopied here for its interest to those who are watching closely the important experiments of Dr. Goddard-Editor)

For the past 12 years the Institution has supported by annual grants the researches of Dr. R. H. Goddard, of Clark University, on the development of a rocket to explore the upper atmosphere. In 1916 Doctor Goddard presented to the Institution such a convincing mathematical demonstration of the theory that a self-propelling rocket could be sent to the limit of the earth's atmosphere, and even beyond, that Doctor Walcott, then Secretary of the Smithsonian, after consultation with a committee of experts, agreed to support the investigation. The work progressed so favorably that the Institution has continued its support until the present time.

The highest level of the air which can now be studied is about 20 miles up, reached by sounding balloons, but these balloons often drift as much as 150 miles from their starting point, and their recovery is slow and uncertain. A rocket, on the other hand, would go straight up to any desired height and provided with a parachute would return in a short time at or very near its starting point. With suitable automatic apparatus, such a rocket could bring back samples of the upper air for chemical analysis, measure the temperature and pressure of the higher atmosphere, expose spectographs above the ozone layer where the ultra violet spectrum of the sun could be observed, and record the condition of the atmosphere from 5,000 feet upward in the interests of aviation. In short, a whole new field of investigation would be opened up--the unknown upper layers of the earth's atmosphere.

This investigation was pioneering in character; little was available as a guide. After much experimenting with a rocket equipped with a device for feeding small charges of high explosive, Doctor Goddard turned finally to the scheme of a steady combustion of hydrocarbon in liquid oxygen. After further modifying the design of the rocket itself to adapt it to the use of this new means of propulsion, Doctor Goddard was ready at the close of the fiscal year for an actual field trial of the device.

It may be said that on July 17, 1929, a trial of the liquid-propelled rocket was made at Worcester, Mass., the device functioning satisfactorily as regards the flow of liquid, the ascent of the rocket, and its rapid motion in air. The trial rocket was guided only by vanes on its rear end, and these proved inefficient, the rocket describing a high arch and returning to the ground instead of making a vertical flight. Doctor Goddard has already designed automatic stabilizers, however, and these together with the necessary automatic recording devices are seemingly all that is needed to insure a successful, practical flight of the rocket to the higher layers of the atmosphere and its return with the first records of an unknown region.

The apparently assured success of Doctor Goddard's experiments has drawn support from a source better equipped financially to provide it than the Smithsonian. The late Simon Guggenheim at Colonel Lindbergh's suggestion made a large grant of funds and set up an advisory committee of which the secretary, Doctor Abbot, is a member. Doctor Goddard's experiments are now going on under these auspices in New Mexico. It is a pleasure to record here that the Smithsonian has again been able to support during its more or less uncertain pioneering stages an investigation of great promise for the increase of knowledge.

CAN MAN EXIST ON OTHER PLANETS?

(This paper, prepared by Mr. Nathan Schachner was scheduled to be read by him at one of the Society's meetings. Illness prevented Mr. Schachner from appearing, and the paper is presented now. The paper of Professor Klemin on stratosphere flight will be published in a future issue.)

Let us first examine what we actually know of man's ability to withstand upon earth, extremes of cold and heat, rarity and density of atmosphere, and other conditions that may approximate what may be expected upon other worlds. What are the limits for continued human existence, not merely for a minute or two, but for extended periods of time, as we know them from man's actual struggle with natural conditions upon earth.

First is the question of the limits of atmospheric density, which man has already encountered and survived. A total lack of breathable atmosphere would render all life impossible, and any planet which possess no breathable atmosphere may be ruled out as a possibility for human existence. If we find that the planet does possess atmosphere, then we must determine whether or not oxygen is present, because without oxygen life is impossible. If we find the presence of oxygen, then we must proceed further and determine the outermost limits, to wit, its conditions of rarefication or density, under which man can survive.

The question of rarefication comes first. The best evidence obtainable on this comes from mountain climbers and aeronauts.

Belmore Browne climbed Mt. McKinley in 1912 and attained an altitude of 20,000 feet. This climb was made in a terrific blizzard, with high winds attaining a velocity of 55 miles per hour, at 15 below zero F., and accompanied by cutting

clouds of needled ice dust. Furthermore, the glacier surface was steep and required heavy step cutting in the icy surface all the way. Nevertheless he and his companion reached the top without ill-effects other than a moderate shortness of breath. At that altitude of almost 4 miles, the atmospheric pressure was approximately four-tenths that at sea level or 6 pounds per square inch.

The records of the Mt. Everest expeditions give even more illuminating data. The native porters of Tibet climbed to the 27,000-foot level under heavy loads of camp equipment without adventitious aids. They suffered no ill-effects. Norton, without oxygen, reached the 28,000 foot level; his companion Somervell scarcely 100 feet less, and Odell twice reached the 27,000 foot level in a blizzard of snow and ice particles and cold of 24 below zero F. These men struggled over steep ice walls and over yawning chasms of wind and at terrific cold, scorning the use of oxygen helmets or artificially heated clothing. At that height the atmospheric pressure was approximately three-tenths that of sea level, or about 4.4 pounds per square inch.

G. Inge Finch, in the Alpine Journal of 1923, volume 35, pages 68-74, discussed "Equipment for High Altitude Mountaineering with special reference to climbing Mt. Everest." He notes that up to the 21,000-foot level, physical functions are practically unimpaired; that at the 23,000-foot level trouble begins. There are winds of gale proportions always blowing and the cold is possibly more intense than even at the poles. He notes one curious effect however; he found that smoking cigarettes relieves to a considerable extent the difficulty in breathing at high altitudes. The effect of one cigarette lasted three hours at altitudes where it was necessary to have recourse to oxygen apparatus. He and his companion were content, after smoking a cigarette, with a half litre of oxygen per minute for both, instead of two litres of oxygen per minute per man without smoking. This is a curious fact that merits considerable further experimentation. It may be that future expeditions to the planets will list as equipment a goodly supply of cigarettes.

Even greater altitudes, with a correspondingly lesser atmospheric pressure, have been attained in airplanes. Lt. MacReady, in 1927, achieved a height of 38,474 feet. At that altitude his instruments disclosed a temperature of 82½ degrees below zero F. He required no artificial oxygen until the 30,000-foot level. At the 35,000-foot level he was inhaling practically pure oxygen. The extreme limit for breathing without artificial aids thus seems to be around the 30,000-foot level or an air pressure of 3½ pounds to the square inch.

It is evident from the data we have mentioned, that trained men can exist without difficulty at heights of 21,000 feet with air pressures of 40% of sea level; that they may exist in altitudes up to 30,000 feet with pressures of 25% to 30% of sea level, with great difficulty; that all human life is impossible without auxiliary aids at heights of 6 miles, or air pressures of less than 25% of sea level.

Turning to denser atmospheres than we are normally accustomed to on earth, I can see no difficulties whatever involved.

Sand hogs, with proper training and graduations of pressures, are accustomed to working in pressures up to 4 atmospheres, and to the best of our knowledge there are no denser atmospheres within the solar system.

Now we come to the next most important question in man's continued existence, either on earth or on other planets, to wit, temperature.

What is his upper limit of temperature? Authenticated temperatures of 140 degrees F. are not uncommon in Arabia. Rihani states in "Around the Coast of Arabia", that he watched soldiers of Ibn Idris drilling at Jaizan, Arabia, in full

equipment, at high moon in the glare of the sun, without any discomfort, while the thermometer read 140 degrees F. Temperatures are claimed for Death Valley of 150 degrees F. and many have lived through them. The temperature in stokeholes of steamers reaches as high as 150 and even 160 degrees F. and the stokers live through them, while performing arduous manual labor. There is no reason for believing that man may not live in temperatures, other conditions remaining ideal, that approach the coagulation point of protoplasm around 185 degrees F.

Taking the other extreme of temperature, to wit, cold, we have much more definite data.

Commander Byrd, in Little America, listed the following temperatures during the cold season: for 114 days the average was 40 below zero F.; for 62 days 50 below; for 33 days 60 below and on 3 days 70 below. The lowest temperature he found was 72 below.

Amundsen gives in the same territory a low of 74.4 below. Lt. MacReady on his altitude flight found his instruments recording $82\frac{1}{2}$ below. This I believe to be the lowest temperature ever recorded.

It is noteworthy that none of these men used electrical heating or artificial warmth. Commander Byrd states that a brisk walk at 50 below proved quite exhilirating. He maintains that low temperatures did not bother his men. It was the wind at low temperatures that was to be feared.

We may say that man may live in temperatures from 140 above zero to 70 below zero, a range of 210 degrees, in reasonable comfort, and that life may be possible up to 170 above and down to 80 or 90 below, provided that wind conditions are normal. With artificial heating it would be possible to attain a considerably lower range of temperatures, but the coagulation point of protoplasm definitely fixes the upper range, if we do not consider the use of what are termed 'Space Suits'.

The third most important item is that of air pressure or density of atmosphere. This is tied up with the problem of breathability. As stated, pressures in excess of normal sea level pressures are not a bar to man's existence, providing that they be kept within reasonable limits,to wit, 3 atmospheres or less. Of course, pressures of tons to the square inch, would crush man into a shapeless pulp. A more important problem is that of lack of pressure.

Let me state that there has been a good deal of nonsense written upon this question. It is widely assumed that in vacua or near vacua, where the pressure is one or two pounds, the human body would explode forthwith; that the vital organs would burst right through the covering of skin and that there would be general messiness. These statements are not backed up with cold scientific data or with the results of experiments. They point to the analogy of a deep sea fish brought to the surface and promptly exploding.

This analogy is false, for deep sea fish, accustomed to pressures literally tons to the square inch, are shifted suddenly to a mere 14.7 pounds to the square inch, making a ratio of many hundreds to one; whereas a shift from 14.7 pounds to the square inch to absolute zero is an inconsiderable drop in comparison.

Furthermore we have statistics and experiments to disprove this unfounded assumption. We know, that man has existed for long periods at elevations of five to six miles, where the atmospheric pressure is only 3 to 4 pounds per square inch, without any difficulty; and that Lt. MacReady achieved a height of 8 miles, where the pressure was only 2.4 pounds to the square inch, without other than what may be termed comparatively minor discomforts.

It is understood that subjecting the body to a total vacuum would prove no picnic. The probabilities are that the inner pressure on the eardrums would cause temporary deafness, that some of the surface capillaries would burst and cause congestion. But these are not major accidents nor necessarily fatal.

But there is even better testimony at hand. Everyone who has taken a high school course in physics, know the interesting experiment of a mouse placed in a bell and the air exhausted until a reasonable vacuum has been attained. The mouse remains in the vacuum for 30 seconds to a minute, and then the air is allowed to enter again.

In no case has the mouse exploded or suffered the horrible effects ordinarily associated with vacua. It drops over on its side, rigid, explainable by the withdrawal of breathable atmosphere. In many instances, if the mouse did not remain in the vacuum too long, it recovered, just as active and spry as before. The ear drums are not torn open nor are the vital organs disarranged.

Two members of the American Museum of Natural History conducted experiments with insects, including butterflies, in vacua. They found that after subjecting these fragile insects to vacua for periods up to 4 minutes, a fair percentage would recover without any visible ill effects. The results of the experimental data was incorporated in an article in the Scientific American during the past year.

It is quite evident that the lack of pressure even down to a near vacuum, should not tragically affect human beings. Of course continued life at pressures of 3 pounds per square inch or less might give rise to cumulative congestion and difficulties with the body organs that would render further existence impossible.

The force of gravity is another element that must be taken into consideration. We know that men in airplane flights, on sharp turns, at high speed, have withstood accelerations corresponding to a gravity of 8. times that on earth. Theoretically man should be able to stand gravity considerably higher. Several members of the Society have performed experiments with mice in centrifuges where they have withstood calculated gravities of 84 without ill effects.

At the other end of the scale, we have no statistics or results of experiment, but there is no reason in theory why such a lessened gravity should have any ill effect.

There are other possible conditions that should be taken into consideration. There is the possibility of dangerous life forms on other planets. The possibility of inimical effects of cosmic rays upon man has been fully and popularly discussed, but I believe that the danger from this source has been considerably overrated. Prof. Piccard attained a height of 10 miles in his hermetically sealed balloon, which did not protect him in the slightest from cosmic rays. At that height the earth's protecting blanket of air above him was very thin, yet neither he nor his assistant suffered from any ill effects.

There is another danger on planets where life of any kind may exist that is quite real, and against which man may not be able to defend himself, to wit, new forms of pathogenic germ life. On earth, where members of a race have not achieved immunity by contact through generations with certain forms of pathogenic bacteria, contact will cause speedy fatalities, even though the natives in that territory are unharmed. So man, upon reaching another planet, will encounter pathogenic micro-organisms that have no counterpart here upon earth, and to which he has no native immunity.

Let us turn now to the various planets and see upon which planets, if any, man may reasonably expect to find life possible, if not exactly comfortable. Let us take the moon first.

It is quite definitely determined that the moon possesses no atmosphere, even though Prof. W. H. Pickering claims that he has discovered minute changes, notably on the floor of the crater, Eratosthenes. He attributes these to a seasonal change of low form vegetation, gray in color. He also claims to have noticed traces of cloud and snow patches, but the weight of the evidence is strongly against him. It may be definitely assumed that man could not exist upon the moon except with complete and continuous use of oxygen apparatus.

As to temperature, on the sunny side, it rises to the boiling point of water, on the dark side, it drops almost instantly to the frigidity of space. Both of these conditions render life absolutely impossible, except, of course, with some form of "space suits," which are supposed to withstand extremes of cold and heat.

The density of the moon is 3.4, water being the unit, and is approximately 2/3 that of earth. It is therefore sufficiently solid to stand upon. Gravity is 1/6 that of earth, so that a normal man of 180 pounds would weigh only 30 pounds on the moon.

M. Lyot, of Meudon, found from a comparison of the reflection of light from the moon with that from various earth materials, that the surface soil of the moon matches almost perfectly with volcanic ash an almost perfect non-conductor of heat. Hence the heat from the sun would not sink more than a half inch below the surface of the moon, even though that surface was at boiling point.

This gives rise to a slight possibility of man's achieving a precarious existence upon the moon. Granted divers' suits such as we know them on earth, equipped with oxygen tanks and electrical heating pads, man with proper tools, might, if there were a sufficient number to work in short relays, dig on the dark side of the moon through this soft material to the eternal coolness, gauging their time to commence work at the beginning of the lunar night.

Then there would be approximately 14 days in which to dig out caverns, roof them over with the volcanic material, seal hermetically, install heating apparatus, oxygen tanks, provide for proper removal of waste gases and perform other tasks to achieve precarious habitability before they were swung again into the blazing heat of the sun. Possible, I admit, but not definitely encouraging.

Mercury presents an even more forbidding face to us. At its close proximity to the sun and presenting eternally one side to the sun, it shows astounding extremes of temperature; 350 degrees C. on the sun side, which is hot enough to boil lead; and on the eternal dark side, the absolute zero of space. The narrow oscillating portion between burning day and glacial night would be subject to tremendous changes of temperature, and if there were an atmosphere, such astrounding storms as we could not conceive of here on earth.

Fortunately, if we may term it that, there is no atmosphere on Mercury, so that life may very definitely be considered impossible there.

On Venus we have an entirely different situation. Venus possesses an atmosphere but it is so dense, so cloudy, and so completely conceals the face of Venus that we on earth are forever debarred from other than vain theories and speculations on the state of affairs upon our sister planet. Furthermore, to our

great discomfiture, the spectroscope discloses no traces whatever of oxygen or water vapor in this very dense atmosphere. This would seem to preclude any further investigations, because without oxygen and water vapor, life as we know it is impossible.

But all that the spectroscope can analyze are the upper reaches of the Venusian atmosphere. Analysis of a similar region of the earth's atmosphere would similarly show the absence of these vital gases, so that while we have no definite knowledge of the composition of the lower atmosphere on Venus, it is quite possible that it contains both oxygen and water vapor. If so, the Venusian atmosphere would be steaming and heavy like that in the earlier stages of the earth's history. The air pressure at the surface might possibly be that of 2 to 3 atmospheres, in which case it might be uncomfortable for man, but not dangerous.

The temperature on the surface of Venus is another moot question. It would depend entirely upon its period of rotation and that is an enigma. Up to recently, astronomers maintained that one side of Venus always faces the sun. If that is true, the sun side would be near the boiling point of water and the dark side would be very cold, though possibly tempered by convection currents from the hot side. The small section subject to libration, would be swept by tremendously fierce cyclones.

Recent observations from Mt. Wilson and Lowell Observatories with the thermopile, check the heat from the dark side at 25 below zero C. and not much more for the bright side. This applies of course only to the upper reaches of the Venusian atmosphere. If however, Venus rotated only once in 225 days, there would be a considerably greater disparity of temperature between the two sides. This and other observations give a period of rotation shorter than one Venusian year. Just what the period is, is not definitely known, though estimates have made it as low as 4 to 5 earth days. In this event, the temperature of the surface of Venus would be fairly well distributed, and though very hot and steamy, would be livable, provided always that oxygen and water vapor were present in the right proportions.

The topography of the planet is entirely unknown, but judging from the dense atmosphere, if water vapor be present, the rains would be continuous, and the surface one vast sea of water. Its density is 4.8 W; its gravity .9 E, which are practically earth conditions.

Given oxygen and water in the atmosphere and a reasonable rotation on its axis, Venus would be substantially habitable.

We come now to the planet Mars, which has excited most discussion as to its probable habitability.

Mars has a diameter of 4200 miles, has a mean distance of 141 million miles from the sun and rotates once in 24 hours, 37 minutes, almost exactly the same as the earth's period. It is the only planet in the solar system of which we have definite knowledge that it possesses an atmosphere of oxygen and water vapor, both of which are essential to human life. Spectroscopic observations disclose an oxygen content 15% that of the earth at sea level, and a water vapor content of 5% of that of the earth's atmosphere. This would indicate an atmospheric density one half that at the summit of Mt. Everest or 2.2 pounds per square inch, which is manifestly not breathable without artificial aids. The water vapor content is also less than that of our hottest and dryest deserts. These percentages are most discouraging.

But note this. The spectroscopic observations apply chiefly to the upper limits of the Martian atmosphere, or at the best to the average means volume of the entire atmospheric blanket. It almost necessarily follows that the atmosphere at the surface of Mars would be considerably denser than the spectroscopic figures imply, and inasmuch as a density of 30% that of sea level density on earth is livable, it is not too presumptuous to believe that mankind could live and breath on the surface of Mars, at least in certain portions of its area. Furthermore, it must be remembered that any valleys or depressions would contain an even greater concentration of oxygen.

While the water vapor content also sounds discouraging, we have before our eyes the natural phenomena of the polar caps, of goodly area, which melt regularly during the Martian spring and summer and extend again during the Martian winter. While some astronomers claim that the caps are composed of frozen carbon dioxide, it is the consensus of opinion that they are in fact snow and ice. If this is so, then there is no reason to assume that there is not a sufficient supply of water vapor for the need of human beings who have accustomed themselves to living in the desert regions of this earth.

I do not intend going into the very troubled question of the so-called 'canals' of Mars, either as to their origin or connotations. Yet there is good reason to believe that the darkening along their paths in the summer time is due to the growth of vegetation, in which case we have another argument for believing that Mars is habitable. Dr. Trumpler, of Lick Observatory, suggests that these canals are depressions in the Martian surface, where higher temperature and accumulations of moisture produce more luxuriant vegetation, thereby becoming visible.

The temperature of Mars has been rather definitely determined: North Polar temperature in winter is minus 70 degrees C.; South Polar in summer, plus 10 degrees C.; at the equator minus 10 to plus 20 degrees C.; for the dark areas, the so-called seas, under the direct sun, minus 5 to plus 5 degrees C.; for the bright desert areas and at night at the equator, minus 45 degrees C. and lower. These temperatures, would be viewed with equanimity by Commander Byrd.

The gravity on Mars is .38 that of earth, which would render earth-men capable of marvelous feats of agility. The density 3.92 W is sufficiently solid.

We may generalize and say with a fair degree of assurance that it is possible for man to exist on Mars.

When we come to the major planets, the scene changes.

Jupiter, the giant of the system, with a diameter of 88,700 miles, a distance of 480 million miles from the sun, presents an entirely different aspect to our investigations. Its atmosphere is so dense that the most powerful telescope has been unable to penetrate to the true surface of the planet. No spectroscopic analysis of the atmosphere has as yet been made. There is a possibility, of course, that it might include breathable air. There certainly could not be water vapor present because of the extremely low temperature. The most plausible explanation is that it consists chiefly of carbon dioxide.

Dr. Harold Jeffreys, in 1924, pictured Jupiter as a rocky core overlaid with ice several thousand miles thick; and the whole surrounded by a dense cloud shell. Jupiter, he claimed, was unutterably cold. Recent bolometer readings at Lowell Observatory supported his views, showing a surface temperature of minus 240 degrees F. This temperature holds good only for the uppermost lawyer of the dense atmosphere.

Jupiter rotates once every 9 hours 50 minutes. This combined with its vast circumference, give rise to a tremendous surface speed. The "trade" winds on Jupiter must be terrific, with cyclones and hurricanes, to which our earth winds are puny affairs. The great red spot of Jupiter, with its constant shifting and changes in size, seem to substantiate this reasoning.

The tremendous velocity of rotation might have one compensating feature. Jupiter's gravity, 2.64 that of earth, would ordinarily impose a crushing load upon the human frame, but the high rotation speed causes a counterthrust to bring it down to comfortable proportions. The density of Jupiter is only 1.34 that of water, which again substantiates the theory of a small rocky core overlaid with a thick gaseous envelope. We may safely say that life on Jupiter is impossible.

Whatever has been said of Jupiter applies with even great force to her sister planets, Saturn, Uranus and Neptune. They are all giants, possess high rotational velocities, their densities are low, and their gravities greater than that of earth. We have no knowledge of the composition of their heavy atmospheres, though we do know that the temperatures of the upper blankets approach the cold of space. There too, life must be impossible. Of Pluto, the new planet, practically nothing is known.

In conclusion we may state our findings as follows:

Mars holds forth the greatest possibility of supporting human life; Venus is the most intriguing for exploration purposes, because of its atmosphere does contain oxygen and water vapor, it would be even more habitable than Mars. The other planets are definitely out of the picture.

SUNSPOTS HELP TO COOL EARTH

Sunspots, contrary to what might be expected are really gigantic refrigerators, stated Dr. Henry Norris Russell of Princeton University, and they operate to cool the earth. The sunspots themselves, he stated, were a full thousand degrees cooler than the surrounding surface of the sun, and their effect is to cool the earth by a full degree.

Sunspots, he said, were caused by the tearing apart of hydrogen atoms in the superheated interior of the sun. The atoms are ionized and the hydrogen nucleus is separated from its electrons, this process generating power for the creation of sunspots.

As the electrons and nuclei unite, they become heated and rise rapidly to the solar circle. In rising the energy of the gaseous mass is depleted and expansion occurs, resulting in a cooling and conversion of the mass of the sunspot into a refrigerator.

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Meetings of the New York members of the American Interplanetary Society are held on the first and third Fridays of each month at the American Museum of Natural History, 77th Street and Central Park West. Associate membership in the Society at $3.00 per year may be obtained by sending the first year's dues to the Secretary, Nathan Schachner, 113 W. 42nd Street, New York. Information on the other classes of membership, active and special may be obtained by writing the Secretary.

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